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Claims:

1. A catalyst (for use in stationary or fluid bed dehydrogenation processes for converting hydrocarbons to olefins and / or diolefins, said catalyst comprising:

a carrier; chromium, in the form of Cr_2O_3 , at a concentration from about 10 wt% to about 30 wt%, based on the total catalyst weight, ~~including the Cr_2O_3~~ ; zirconium, as a promoter, in the form of ZrO_2 , at a concentration from about 0.1 wt% to about 15 wt% zirconium based on the total catalyst weight, ~~including the ZrO_2~~ , and magnesium, as a promoter, in the form of MgO , at a concentration from about 0.1 wt% to about 15 wt% magnesium, based on the total catalyst weight, ~~including the MgO~~ .

2. The catalyst of Claim 1 wherein the carrier is selected from a group consisting of aluminum oxide, alumina, alumina monohydrate, alumina trihydrate, transition alumina, gamma-alumina, delta-alumina, eta-alumina, alumina-silica, silica, silicates, zeolites, bayerite, gibbsite, nordstrandite and combinations thereof.

3. The catalyst of Claim 1 wherein the carrier has a surface area of from about 15 m^2/g to about 300 m^2/g , a pore

volume of from about 0.2 cc/g to about 1.5 cc/g, and an average pore diameter of from about 3 nm to about 30 nm.

4. The catalyst of Claim 1 wherein the carrier has a particle size of from about 20 μm to about 150 μm .

5 5. The catalyst of Claim 1 wherein the carrier comprises an alumina carrier that is spray-dried or pelletized and calcined at from about 500°C to about 1100°C.

6. The catalyst of Claim 1 wherein the chromium promoter is derived from ^{a member selected from} the group consisting of CrO_3 ,
10 inorganic chromium salts, ~~including~~ ammonium chromate, ammonium dichromate, ~~and~~ chromium nitrate, organic chromium salts, and combinations thereof.

7. The catalyst of Claim 1 wherein the chromium promoter is present in the form of Cr_2O_3 at a concentration
15 from about 15 wt% to about 28 wt%, based on the total catalyst weight, ~~including the Cr_2O_3 .~~

8. The catalyst of Claim 1 wherein the chromium promoter is added in the form of a CrO_3 solution that is impregnated onto the alumina carrier.

20 9. The catalyst of Claim 1 wherein the zirconium promoter is present in the form of ZrO_2 at a concentration of from about 0.1 wt% to about 5 wt%, based on the total catalyst weight, ~~including the ZrO_2 .~~

10. The catalyst of Claim 1 wherein the zirconium promoter is present in the form of ZrO_2 at a concentration of from about 0.5 wt% to about 1.5 wt%, based on the total catalyst weight, ~~including the ZrO_2 .~~

5 11. The catalyst of Claim 1 wherein the zirconium promoter is co-impregnated on the carrier with the chromium promoter.

10 12. The catalyst of Claim 1 wherein the magnesium promoter is present in the form of MgO at a concentration from about 0.1 to about 2 wt%, based on the total catalyst weight, ~~including the MgO.~~

15 13. The catalyst of Claim 1 further comprising from about 0.3 to about 2 wt%, based on the total catalyst weight, of an alkali metal promoter, expressed in the form of an alkali metal oxide.

14. The catalyst of Claim 1 further comprising at least one additional promoter selected from the group consisting of scandium, yttrium, lanthanum, titanium, hafnium and combinations thereof.

20 15. A dehydrogenation catalyst comprising:

a carrier selected from the group consisting of aluminum oxide, alumina, alumina monohydrate, alumina trihydrate, transition alumina,

gamma-alumina, delta-alumina, eta-alumina,
bayerite, gibbsite, nordstrandite, alumina-silica,
silica, silicates, zeolites and combinations
thereof, having a surface area from about 15 m²/g
to about 300 m²/g, a pore volume from about 0.2
cc/g to about 1.5 cc/g, and an average pore
diameter from about 3 nm to about 30 nm;

chromium, as a promoter, ~~in the form of~~ ^{calculated as} Cr₂O₃, at
a concentration from about 15 wt% to about 28 wt%,

based on the total catalyst weight, ~~including the~~
Cr₂O₃, wherein the chromium is derived from ^{a member selected from} the
group consisting of CrO₃, ammonium chromate,
ammonium dichromate, chromium nitrate, organic
chromium salts, other inorganic chromium salts,
and combinations thereof;

zirconium, as a promoter, ~~calculated as~~ ^{in the form of} ZrO₂, at a
concentration from about 0.1 wt% to about 5 wt%
zirconium, based on the total catalyst weight,
~~including the ZrO₂~~; and

magnesium, as a promoter, calculated as MgO, at a
concentration from about 0.1 to about 2 wt%, based
on the total catalyst weight ~~including the MgO~~.

16. The catalyst of Claim 15 wherein the chromium promoter is present at a concentration from about 17 wt% to about 24 wt%, based on the total catalyst weight, ~~including the Cr_2O_3~~ .

5 17. The catalyst of Claim 15 wherein the chromium is added in the form of a CrO_3 solution that is impregnated onto the alumina carrier.

10 18. The catalyst of Claim 15 wherein the zirconium promoter in the form of ZrO_2 is present at a concentration from about 0.5 wt% to about 1.5 wt%, based on the total catalyst weight, ~~including the ZrO_2~~ .

15 19. The catalyst of Claim 15 wherein the magnesium promoter in the form of MgO is present at a concentration from about 0.5 to about 1 wt%, based on the total catalyst weight, ~~including the MgO~~ .

20. The catalyst of Claim 15 wherein the zirconium is co-impregnated on the carrier with the chromium and the magnesium.

20 21. The catalyst of Claim 15 further comprising from about 0.3 to about 2 wt%, based on the total catalyst weight, of an alkali metal promoter, expressed in the form of an alkali metal oxide.

22. The catalyst of Claim 15 further comprising at least one promoter selected from the group consisting of scandium, yttrium, lanthanum, titanium, hafnium and combinations thereof.

5 X 23. The catalyst of Claim 15¹⁵ used for dehydrogenation in a stationary or fluid bed.

10 24. A dehydrogenation catalyst comprising:
a carrier¹⁵ selected from the group consisting of aluminum oxide, alumina, alumina monohydrate, alumina trihydrate, transition alumina, gamma-alumina, delta-alumina, eta-alumina, bayerite, gibbsite, nordstrandite, alumina-silica, silica, silicates, zeolites and combinations thereof, and having a surface area from about 15 m²/g to about 300 m²/g, a pore volume from about 0.25 cc/g to about 0.35 cc/g, and an average pore diameter from about 3 nm to about 30 nm¹⁵, wherein said carrier is spray-dried or pelletized and calcined;

20 ✓ chromium as a promoter, ^{calculated as} ~~in the form of~~ Cr₂O₃, at a concentration from about 17 wt% to about 24 wt%, based on the total catalyst weight, ~~including the~~ Cr₂O₃, wherein said chromium is derived from the ^{or member selected from} ~~the~~

group consisting of CrO_3 , ammonium chromate, ammonium dichromate, chromium nitrate, organic chromium salts, other inorganic chromium salts, and combinations thereof, wherein said chromium is added to the support in the form of a CrO_3 solution that is impregnated onto the carrier; an alkali metal, as promoter, ~~calculated as an alkali metal oxide~~, at a concentration from about 0.3 wt% to about 2 wt%, based on the catalyst weight, ~~including the alkali metal oxide~~;

zirconium as a promoter, calculated as ZrO_2 , at a concentration from about 0.5 wt% to about 1.5 wt% zirconium, based on the total catalyst weight, ~~including the ZrO_2~~ ; and

magnesium as a promoter, calculated as MgO , at a concentration from about 0.5 wt% to about 1 wt% magnesium, wherein the magnesium is co-impregnated on the carrier with the chromium and zirconium.

25. The catalyst of Claim 24 further comprising at least one promoter selected from the group consisting of scandium, yttrium, lanthanum, titanium, hafnium and combinations thereof.

26. The catalyst of Claim 24⁹ used for dehydrogenation in a stationary or fluid bed.

27. The catalyst of Claim 24 wherein the alkali metal promoter comprises about 0.3 to about 1 wt% Na_2O , based on the total catalyst weight, ~~including the Na_2O .~~

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